

## **REMARKS**

**The Examiner rejected Claims 13 and 15 under 35 U.S.C. 102(a) as being anticipated by Green (US 2003/014 7652). Applicant traverses the rejection.**

Claim 13 requires the light from each light source in a first module to be directed to a second module with a first common collimating lens. Claim 13 also requires a second common collimating lens to direct that light to corresponding detectors in an array of detectors in the second module.

The Examiner points to Figure 10 and identifies element 135 as the light source array, and element 37 as the first collimating lens. Applicant submits that element 37 is not a collimating lens but a beam expanding telescope. A collimating lens is generally understood to be a lens which transforms either a divergent or, less typically, convergent, beam into a parallel beam, or vice versa. Applicant directs the Examiner's attention to a definition of collimation given in the glossary of Melles Griot Inc at

<http://www.mellesgriot.com/glossary/wordlist/glossarydetails.asp?wID=412>

as the “process of minimizing divergence and convergence (i.e., making the beam as parallel as possible”. A collimating lens is a lens that can perform this process. Another web resource, [www.answers.com](http://www.answers.com) defines a collimating lens similarly as “A lens on a collimator used to focus light from a source near one of its focal points into a parallel beam.” Element 37 is not near the focal point of the beam on which it acts, as it operates on a beam of light that is already parallel. Moreover, paragraph 35, to which the Examiner points, makes it clear that the function of element 37 is simply to expand the beam, both to ease alignment and to improve data integrity.

Second, the Examiner points to Figure 6 and identifies element 71 as the second common collimating lens required by the Claim. Applicant submits that element 71, like element 37, is a telescope. In this case, the telescope is used to reduce the beam size, not expand it, but again it is certainly not a collimating lens.

Hence, Applicant submits that Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Accordingly, Claim 13 and the Claims dependent therefrom are not anticipated by Green.

Claim 15, which depends from Claim 13, further requires that the first common collimating lens not only directs the light from each light source to a second module but also directs light from the second module back to an array of detectors in the first module. The Examiner points to Figure 13 as providing this teaching. Applicant submits that the only element that collimates light from the light source 177 shown in Figure 13 is the micro-lens array 191, and that this element 191 plays no part in directing light back from the second module to the detector array 175. Indeed, the light from the second module does not reach element 191. Hence, Applicant submits that this additional limitation of Claim 15 is not taught by Green, and hence, there are additional reasons for allowing this Claim.

**The Examiner rejected Claims 1, 2, 5, 11 and 18 under 35 U.S.C. 103(a) as being unpatentable over Green. Applicant traverses the rejection.**

Regarding Claim 1, the Examiner states that Green discloses all the limitations of the Claim except for explicitly teaching that the array of detectors is part of a die. Applicant disagrees with the Examiner's reading of Green.

Claim 1 requires a first common collimating lens for directing the light from each light source to a second module, and a second common collimating lens for directing the light from the light sources to corresponding detectors in the array of detectors. The Examiner points to Figure 10 and identifies element 135 as the light source array, and element 37 as the first collimating lens. As noted above with respect to Claim 13, Applicant submits that element 37 is not a collimating lens but a beam expanding telescope. Paragraph 35, to which the Examiner points, makes it clear that the function of element 37 is to expand the beam size, both to ease alignment and to improve data integrity. The Examiner points to Figure 6 and identifies element 71 as the second common collimating lens required by the Claim. As noted above with respect to Claim 13, Applicant submits that element 71, like element 37, is a telescope. In this case, the telescope is used to reduce the beam size, not expand it, but again

it is certainly not a collimating lens. Hence, Applicant submits that Green does not teach the limitations of the Claim relating to the first and second collimating lenses.

Accordingly, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 1 and the Claims dependent therefrom.

Claim 5, which depends from Claim 1, further requires the first common collimating lens to not only direct the light from each light source to a second module but also direct light from the second module back to an array of detectors in the first module. The Examiner points to Figure 13 as providing this teaching. As noted above with respect to Claim 15, Applicant submits that Figure 13 shows that the only element that collimates light from the light source 177 is the micro-lens array 191, and that this element 191 plays no part in directing light back from the second module to the detector array 175. Indeed, the light from the second module does not even come in contact with element 191. Hence, Applicant submits that this additional limitation of Claim 5 is not taught by Green and that there are additional reasons for allowing this Claim.

Claim 11, which depends from Claim 1, further requires an array of light sources at the second module, whose light is directed back to the first module by the second common collimating lens. The Examiner points to Green's disclosure of co-located transmitter and receiver arrays for the first module, and maintains that it would have been obvious to use a similar arrangement of co-located transmitter and receiver arrays for the second module as an engineering design choice. Applicant submits that the Examiner's proposed motivation for modifying the system taught by Green in the manner suggested is flawed.

Green teaches the use of a second array of light sources at the first module, sending unmodulated light to the second module, where an array of reflective modulators is used to modulate the received light and send it back to the first module. This arrangement allows signals to be transmitted optically from the second module to the first. The Examiner has not pointed to any reason suggested in Green or elsewhere for modifying this arrangement by replacing the modulator array with a second light source array. Indeed, Applicant submits that as the QSCE modulator array 207 taught by Green may also be used as a detector array, it has specific additional value to the system taught by Green. Hence, Applicant submits that the

modification suggested by the Examiner would be much more significant than a mere “engineering design choice”. Accordingly, there are additional reasons for allowing Claim 11.

With regard to Claim 18, which depends from Claim 13, the Examiner states that Green discloses all the limitations of Claim 18 except for the requirement that the second common collimating lens directs light from an array of light sources at the second module to the first module. As noted above with respect to Claim 11, Green does not even teach the existence of an array of light sources at the second module. Based on Green’s disclosure of co-located transmitter and receiver arrays for the first module, however, the Examiner maintains that it would have been obvious to one of ordinary skill in the art at the time of the invention “to use a similar arrangement of co-located transmitter and receiver arrays for the second module, as described above for Claim 11”.

First, Applicant submits that Green does not teach the limitations of Claim 13, from which Claim 18 depends. Specifically, as noted above with respect to Claim 13, Green does not teach the limitations of the Claim relating to the first and second collimating lenses.

Second, Applicant submits that the Examiner’s proposed motivation for modifying the system taught by Green in the manner required to satisfy the additional requirements of Claim 18 is flawed. As noted above with respect to Claim 11, the Examiner has not pointed to any reason suggested in Green or elsewhere for replacing the reflective modulator array 207 taught by Green with a source array. Hence, Applicant submits that there would be no motivation to make the modification suggested by the Examiner.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 18.

**The Examiner rejected Claims 3, 4, 9 and 10 under 35 U.S.C. 103(a) as being unpatentable over Green in view of Kube, et al (hereafter "Kube") (US 2004/003 3078). Applicant traverses the rejection.**

Regarding Claims 3 and 9, the Examiner states that Green discloses all the limitations of the Claims except for specifying that the light sources and detectors are spaced apart by 50

microns. The Examiner looks to Kube for the missing teachings. The Examiner maintains that it would have been obvious to space the transmitters and receivers in the arrays of Green “within tens of microns in order to reduce the size of the optical components and allow a larger number of components in the same array space, as suggested by Kube.”

First, as noted above with respect to Claim 1, from which Claims 3 and 9 depend, Green does not teach the limitations of the Claims relating to the first and second collimating lenses. Kube does not provide the missing teachings.

Second, Applicant disagrees with the Examiner’s reading of Kube as providing the teachings relating to the spacing of sources and detector. Paragraph 0043 in Kube, to which the Examiner points, relates not to the **spacing** of the components being within tens of microns, but to the **tolerances** within which the components are positioned (line 8) to achieve those spacings. In other words, the actual spacings of the components may be much larger. Accordingly, Kube does not teach the required spacings.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claims 3 and 9.

Regarding Claim 4, the Examiner states that Green discloses all the limitations of the Claim except for requiring that the first die further comprises another array of detectors to which the first common collimating lens directs light coming from the second module. The Examiner looks to Kube for the missing teachings. Applicant disagrees with the Examiner’s reading of Green and Kube.

First, as noted above with respect to Claim 1, from which Claim 4 depends, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Kube does not provide the missing teachings.

Second, Applicant submits that the passages in Kube to which the Examiner points relate to the advantages of avoiding packaging and housings (paragraph 42) by the use of either a **carrier plate** on which a plurality of passive optical elements may be mounted or formed in order to ease alignment issues (paragraph 0038) or a **circuit board** on which active

or passive optical elements may be mounted or directly integrated (paragraph 40). The Examiner has not pointed to any teachings in Kube that relate to an array of sources and an array of detectors being fabricated on the same wafer, let alone the same die.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 4.

Regarding Claim 10, the Examiner states that Green discloses all the limitations of the Claim except for requiring that the second die further comprises another array of light sources, the light from which is directed back to the first module by the second common collimating lens. First, the Examiner points to Green's disclosure of co-located transmitter and receiver arrays for the first module, and maintains that it would have been obvious to use a similar arrangement of co-located transmitter and receiver arrays for the second module as an engineering design choice. Second, the Examiner suggests that as Kube discloses a free-space array based optical transceiver where the transmitter elements and receiver elements are together on the same die, it would have been obvious to "form the array of detectors on the same second die as the transmitters for the second module, in order to reduce the space needed for the optical components". Applicant disagrees with the Examiner's reading of Green and Kube.

First, as noted above with respect to Claim 1, from which Claim 10 depends, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Kube does not provide the missing teachings.

Second, as noted above with respect to Claim 11, the Examiner has not pointed to any reason suggested in Green or elsewhere for replacing the second module's reflective modulator array 207 taught by Green with a source array. Hence, Applicant submits that there would be no motivation to make the modification suggested by the Examiner.

Third, as noted above with respect to Claim 4, Applicant submits that the passages in Kube to which the Examiner points relate to the advantages of avoiding packaging and housings by the use of either a **carrier plate** on which a plurality of passive optical elements may be mounted or formed in order to ease alignment issues, or a **circuit board** on which

active or passive optical elements may be mounted or directly integrated. The Examiner has not pointed to any teachings in Kube that relate to an array of sources and an array of detectors being fabricated on the same wafer, let alone the same die.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 10.

**The Examiner rejected Claims 6 , 12, 14 and 17 under 35 U.S.C. 103(a) as being unpatentable over Green in view of Green, et al (hereafter "Green 2") (US 2002/014 1011). Applicant traverses the rejection.**

Regarding Claim 6, the Examiner states that Green discloses all the limitations of the Claim except for the use of a third common collimating lens for directing light from the second module to an array of detectors at the first module. The Examiner looks to Green2 for the missing teachings. The Examiner maintains that it would have been obvious to use a lens for each of the transmitter and receiver arrays "as an engineering design choice in implementing the optics for co-located arrays already disclosed by Green". Applicant disagrees with the Examiner's reading of Green and Green2. Applicant further submits that the motivation suggested by the Examiner for modifying the system taught by Green according to the teachings of Green2 is flawed.

First, as noted above with respect to Claim 1, from which Claim 6 depends, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Green2 does not provide the missing teachings.

Second, the Examiner points to Figure 2 and paragraphs 0025-0032 of Green2 as teaching co-located optical transmitter and receiver arrays, with a corresponding lens for each array. Applicant submits that the lenses taught by Green2 are not collimating lenses, as required by Claim 6, but telecentric lenses. The telecentric lens 48 operating on the source array creates a "fan" of parallel beams directed outwards in different directions, one direction for each source element. Similarly, the lens 53 collects light from a wide cone of angular directions, one direction providing light for one corresponding detector element. Furthermore, the Examiner has not pointed to any teaching that this lens 53 receives light from a second

module. Hence, Applicant submits that Green2 does not provide the teachings missing from Green relating to a third common collimating lens directing light from the second module to an array of detectors at the first module.

Third, Applicant submits that the Examiner has not pointed to any way in which the system shown in Figure 13 of Green could even accommodate a third common collimating lens. Applicant submits that the introduction of such a lens into the system shown, which already includes a telescope 37, two micro-lens arrays 191 and 199, a quarter wave plate 197 and a polarization beam splitter, would be much more significant than a mere “engineering design choice”. Furthermore, the Examiner has not pointed to any benefit in replacing the micro-lens array 199 in the system taught by Green with a third collimating lens.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 6.

Regarding Claim 12, the Examiner states that Green discloses all the limitations of the Claim except for the second module further comprising a third die comprising another array of light sources, and the use of a third common collimating lens for directing the light from the second module to the first module. First, the Examiner points to Green’s disclosure of co-located transmitter and receiver arrays for the first module, and maintains that it would have been obvious to use a similar arrangement of co-located transmitter and receiver arrays for the second module as an engineering design choice. Second, the Examiner suggests that, based on Green2’s disclosure, it would have been obvious to “use a lens for each of the transmitter and receiver arrays as an engineering design choice in implementing the optics for co-located arrays, as described above for Claim 6.”

First, as noted above with respect to Claim 1, from which Claim 12 depends, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Green2 does not provide the missing teachings.

Second, as noted above with respect to Claim 11, the Examiner has not pointed to any reason suggested in Green or elsewhere for replacing the second module’s reflective

modulator array 207 taught by Green with a source array. Hence, Applicant submits that there would be no motivation to make the first modification suggested by the Examiner.

Third, as noted above with respect to Claim 6, Green2 does not provide the missing teachings regarding the use of a third common collimating lens for directing the light from the second module to the first module.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 12.

Regarding Claim 14, the Examiner states that Green discloses all the limitations of the Claim except for directing light from the second module with a third common collimating lens to detectors in the first module. The Examiner points to Green2 and maintains that it would have been obvious to “use a lens for each of the transmitter and receiver arrays as an engineering design choice in implementing the optics for co-located arrays, as described above for Claim 6”.

First, Applicant submits that Green does not teach the limitations of Claim 13, from which Claim 14 depends. Specifically, as noted above with respect to Claim 13, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Green2 does not provide the missing teachings.

Second, as noted above with respect to Claim 6, Green2 does not disclose a third common collimating lens for directing the light from the second module to the first module.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 14.

Regarding Claim 17, the Examiner states that Green discloses all the limitations of the Claim except for a third common collimating lens directing light from an array of light sources in the second module to the first module. First, the Examiner points to Green’s disclosure of co-located transmitter and receiver arrays for the first module, and maintains that it would have been obvious to use a similar arrangement of co-located transmitter and

receiver arrays for the second module as an engineering design choice. Second, the Examiner suggests that, based on Green2's disclosure, it would have been obvious to "use a lens for each of the transmitter and receiver arrays as an engineering design choice in implementing the optics for co-located arrays, as described above for Claim 6."

First, as noted above with respect to Claim 13, from which Claim 17 depends, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Green2 does not provide the missing teachings.

Second, as noted above with respect to Claim 11, the Examiner has not pointed to any reason suggested in Green or elsewhere for replacing the second module's reflective modulator array 207 taught by Green with a source array. Hence, Applicant submits that there would be no motivation to make the first modification suggested by the Examiner.

Third, as noted above with respect to Claim 6, Green2 does not provide the missing teachings regarding the use of a third common collimating lens for directing the light from the second module to the first module.

Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 17.

**The Examiner rejected Claim 8 under 35 U.S.C. 103(a) as being unpatentable over Green in view of Pavelchek (US 2002/007 1160). Applicant traverses the rejection.**

Regarding Claim 8, the Examiner stated that Green discloses all the limitations of the Claim except for the array of detectors comprising an array of positive-intrinsic-negative (PIN) photodiodes. The Examiner looks to Pavelchek for the missing teachings. The Examiner maintains that it would have been obvious to use PIN photodiodes for the photodiodes of Green, because PIN photodiodes are less complicated to implement than other types of photodiodes.

Applicant disagrees with the Examiner's reading of Green. As noted above with respect to Claim 1, from which Claim 8 depends, Green does not teach the limitations of the Claim relating to the first and second collimating lenses. Pavelchek does not provide those missing teachings. Hence, Applicant submits that the Examiner has failed to make a *prima facie* case for obviousness with respect to Claim 8.

I hereby certify that this paper is being sent by FAX to 571-273-8300.

Respectfully Submitted,



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Date: April 25, 2007

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